# " AN EXPERIMENTAL STUDY TO ASSESS THE EFFICACY OF A PLANNED PHYSICAL TRAINING PROGRAMME IN MANAGING KNEE PAIN , FOLLOWING HIGH INTENSITY MILITARY TRAINING IN INDIAN ARMY RECRUITS"


**A DISSERTATION SUBMITTED TO THE TAMILNADU**

**Dr. M.G.R MEDICAL UNIVERSITY, CHENNAI.**

**AS PARTIAL FULFILLMENT OF THE**

**MASTER OF PHYSIOTHERAPY DEGREE**

**APRIL 2012**

# CERTIFICATE

Certified that this is the bonafide work of **MR.THOMAS CHERIAN** of K.G. College of Physiotherapy, Coimbatore submitted in partial fulfillment of the requirements for the Master of Physiotherapy Degree course from the Tamil Nadu Dr.M.G.R. Medical University under the **Registration No: 27102219** for the April 2012 Examinations.

**Date:** **Principal**

*A Dissertation on*

**" AN EXPERIMENTAL STUDY TO ASSESS THE EFFICACY OF A PLANNED PHYSICAL TRAINING PROGRAMME IN MANAGING KNEE PAIN , FOLLOWING HIGH INTENSITY MILITARY TRAINING IN INDIAN ARMY RECRUITS"**

***has been submitted in partial fulfillment for the requirement of the Master of Physiotherapy degree,***

***April 2012***

**Internal Examiner** **External Examiner**

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First and foremost, I wish to acknowledge my heartfelt gratitude to the **LORD ALMIGHTY** for his presence and guidance throughout my study period.

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# I. INTRODUCTION

Athletes and soldiers must develop and maintain high levels of physical fitness for the task they perform. But the routine physical activity during the training they undergo is not enough to achieve and sustain physical fitness, which results in training related injuries, and also it will leads to highest number of working days lost.

Knapik, Reynolds et al., (1993) demonstrated that the training related injuries are the main causes for man power loss in the army.

The main causes for their injuries are over-strain and lack of fitness education, during the training session in the Army recruits.

Kaufman et al., (2000) explained that overuse training injuries can be avoided while still maximising physical fitness.

Our body can absorb normal forces generated during daily activities without causing inflammatory response. Excessive normal force includes either high repetitive activities with a low load or low repetition activities with a high load leads to traumatic injuries.

Piantanida, Brannen et al., (2000) showed that approximately 25% of male and 50% of female U S marine officer recruits sustained one or more injury during 6 weeks of basic training programs in 1997.

Lauder et al., (2000) has described that the major spotting injury in the army were the knee joint and which involves the anterior cruciate ligament and the meniscus.

Milgram ,Giladi., (1996) demonstrated that the natural history of anterior knee pain caused by over activity , 15% of Israeli army recruits had knee pain during 14 weeks of military training program.

An individual's biomechanical structure can be responsible for a predisposition to knee injuries. These factors should be identified as a part of the screening examination and the individuals should be counselled as to beneficial type of sports and re-medical exercise program and supportive devices that might minimize the chance of reinjures.

Cahill, Griffin et al., (1979) have demonstrated that knee injuries can be prevented with appropriate exercise and pre-season conditioning programs.

Physical conditioning programme may also serve as a functional pre-disposition. Conditioning provides many benefits, such as increased tensile strength in the ligaments and muscles around the joint which are exercised.

Popovich ,knapic et al., (2000) noted that the reduction in risk of overuse injuries may be achieved by adjusting exercise routines before training.

Previous injuries are also pre-disposing factors to knee disorders.

Results of some of the studies have shown that neuromuscular fatigue causes a number of biomechanical alterations that may increase the risk of non-contact ACL injury during landing. Therefore it has been suggested that a fatigue element should be incorporated into injury prevention and rehabilitation program.

As knee pain is the most common training related injury in army recruits, evidence suggest that planned physical training programme, that includes stretching, strengthening, fitness education and plyometrics would help in preventing and managing the knee pain caused by the high intensity training programme.

Kaufman et al., (2000) demonstrated that preventive strategies in military training program should aims at the primary risk factors for musculoskeletal injuries. These include the intensity of training sections, level of physical fitness and the type of foot wear.

## 1.1 NEED FOR THE STUDY

Military officers play a pivotal role in our society. Because of the wide range of their physical activities they may be exposed to different health problems.

The number of army recruits coming to our KG PHYSIO OPD for knee pain due to training related injuries is gradually increasing day by day.

According to literature reviews stretching, strengthening, fitness education and plyometrics is significant in prevention of knee pain due to high intensity training.

But there are no studies done among the Indian army recruits to compare the effects of high intensity training programme with and without a planned physical training programme.

## 1.2 OBJECTIVES OF THE STUDY

- To find out the effect of the Planned Physical Training Programme in prevention of knee injury and reduction of knee pain in Indian Army Recruits.
- To find out the effect of the Normal High Intensity Training Programme in prevention of knee injury and in Indian Army Recruits.
- To compare the effect of Planned Physical Training Programme and Normal High Intensity Training Programme in prevention of knee injury and reduction of knee pain in Indian Army Recruits.

## 1.3 STATEMENT OF THE PROBLEM

This study is to assess the effectiveness of planned physical training programme on the incidence of knee pain in army recruits undergoing a 12 weeks high intensity training program.

## 1.4 HYPOTHESIS

### Null hypothesis:

There is no significant difference between high intensity training programme with and without a planned physical training programme among the army recruits.

### Alternative hypothesis:

There is a significant difference between high intensity training programme with and without planned physical training programme among the army recruits.

## 1.5 KEY WORDS

- knee pain
- Planned physical training programme
- Stretching
- Strengthening
- Fitness education
- Plyometrics
- High intensity military training programme

# II. REVIEW OF LITERATURE

**Carlssin AM et al., (1983)**

The VAS is a simple and frequently used method for the assessment of variation in intensity of pain in clinical practice. The percentage relief assessed by VAS is often considered as a measure of the efficacy of the treatment.

**Mc Cormack HM et al., (1988)**

This study was conducted to analyze the reliability and validity of VAS .The VAS has been established as a simple scale for measuring the subjective experience of pain .VAS has been established in the many years as a valid and reliable tool in clinical and research studies .The study concludes that the VAS is a simple, reliable and valid tool for measurement of subjective pain.

**Zeinstra SM, Bernson et al., (1991)**

Exercise therapy is more effective in treating patello femoral pain syndrome than any other intervention with respect to pain reduction and functional improvement.

**Shwayhat, Hofherr et al., (1994)**

This is a prospective study which examined the running history as a risk factor for recruits overuse injury in sea, air and land (SEAL).The study was conducted in 224 recruits and all are undergo 6 months of vigorous training. And the results shows that the incidence of overuse injuries is 3.4/1000 recruits per day.

**Lloyod et al., (1996)**

Co-contraction of the lower extremity musculature may be responsible for the increased joint stability in the knee during athletic manoeuvre and it is the mechanism by which training program helps to decrease the knee injury

**Hartig, Hendreson et al., (1999)**

Purpose of the study is to examine the role of stretching intervention for reducing over use lower limb injuries in military recruits. Total number of samples is 298 and they are divided in control group (148 members) and intervention group (150 members). During 13 weeks of study duration the intervention group under went stretching exercise for hamstring musculotendinous units. The results shows that the incidence of injury is less in intervention group (16.7%) compared with the control group (29.1).

**EW Yeung, SS Yeung et al., (2001)**

The study was conducted to identify the interventions which help to prevent the lower limb soft tissue injuries caused by running .The study was conducted to identify the effect of modification of the training schedules which includes 1177 participants who were divided into 2 groups , an experimental group (514) and control group (663) , the study examined the effect of different modification of volume of training (frequency , duration , running distance) on the incidence of injury .Thee results showed that the people who train 1-3 days a week and 15 – 30 minutes a day is less likely to develop lower limb injury than who undergo training 5 days a week and 45 minutes training a day.Also the study findings concludes that a reduction in the running distance is significantly effective in reduction of lower limb injuries .

**Hartig, Henderson et al., (2001)**

This study was conducted to study the effect of stretching intervention in preventing lower limb injuries .A total of 5103 participant were included in the study and were divided into two groups an intervention group (1944 participants) and a control group (3159 participants) .The intervention group was treated with various types of stretching exercise prior to the exercise session .The study concluded that the intervention group had a less incidence of lower limb injuries compared to the control group.

**Milgrom et al., (2001)**

This study aimed at assessing the effect of footwear modification in prevention of lower limb injuries in runners .A total of 3519 participants were included in the study and were divided into two groups, an intervention group (716 participants) and the control group (2803 participants) .The study was conducted for a period of 14 weeks in military training programme .The study findings shows that there is a significant reduction in the anterior knee pain in the military recruits.

**Robert G.Marx, Edward .C.Jones et al., (2001)**

The study was conducted to assess the reliability, validity and responsiveness of 4 knee outcome scales which includes Lysholm scale, Cincinnate knee rating scale, American –Academy of orthopaedic surgeon sports knee rating scale and Activities of daily living scale of knee outcome survey. A total of 133 patients with knee pain and who actively involved in sports were included in this study. The reliability and validity was high for all the 4 scale. The standard response mean was 1.1 for the Activity of daily living scale and 0.8 for Cincinnate knee rating scale. The study concluded that all the 4 scales are valid for all the clinical researches.

**M.Bizzini , M.Gorelick et al., (2001)**

The study aimed at analyzing the reliability and validity of Knee outcome survey Activity of daily living scale. A total of 108 subjects were included among them 57 were males and 51 were females. All the subjects were asked to complete the pre and the post questionnaire and the results shows that Knee outcome survey scale has a good reliability and internal consistency.

**SS Yeung et al., (2001)**

The study was conducted to analyze the effect of modification of training schedule and also includes the reduction of training loads should reduce the incidence of injury in runners .The study was concluded that training for a period of 1-3 days / week for a duration of 15 – 30 minutes with 85- 90% of maximum heart rate will help in reduction of incidence of lower limb injuries and also improved the cardio respiratory endurance.

**Lealth Jesen, Stephanic et al., (2005)**

Patellar mobilisation, quadriceps muscle strengthening exercise and flexibility of hamstring and Illiotibal band are effective to relive pain and to enhance functional recovery for anterior knee pain.

**Boonstra AM, Schiphorst et al., (2008)**

This study was conducted to measure the reliability and validity of visual analog scale in measuring the disability in patients with chronic musculoskeletal pain .For the reliability of study a test-re-test design and for the validity a cross-sectional design was used .A total of 396 patients over the age of 18 years who were suffering from chronic musculoskeletal pain was included in this study. They were divided into 2 groups one was a reliability group consisted of 52 patients and the other was a validity group consisted of 344 patients .Spearman's correlation was used as the outcome measurement tool for the reliability study and SF-36 score, VAS pain scores. The study concludes that the reliability of VAS was moderate to good.

**Small K, Mc Naughton et al., (2009)**

This study described the effectiveness of field based injury prevention exercise on eccentric hamstrings strength during soccer match play. For this study 16 semi professional soccer players are completed the soccer specific aerobic field test (SAFT 90) and divided into 2 groups .One group performed hamstring eccentric strengthening during the cool down and the second group performed the same exercise in the warm up phase, twice in a week . After 8 weeks of intervention programme the baseline test was repeated .The findings indicated that the training interventions had a time dependent beneficial effect

on eccentric hamstring strength and that strength training conducted post – training significantly reduced the negative influence of fatigue.

**Bruce H Jones et al., (2010)**

The study aimed at analyzing the risk factors for exercise related injuries among the female and male army recruits .A total of 310 participants were included in the study among them 124 were men and 186 women .Questionnaires were used to collect information regarding past activities, sports participation .On the basis of study findings they concluded that low aerobic fitness and females were more exposed to the risk of training injuries.

**Roopchand-Martin S, Lue-Chin P., (2010)**

The study was to examine the effect of polymeric training program on jump performance and agility .In Jamaican netball team. In this study included 18 net ball players, the outcome measures are included Vertical jump test, broad jump test, Illinois Agility Test before and after the training program. Duration of training program was 3 weeks. For data analysis had used paired t test. The results are declared that the plyometrics is effective for jump performance and agility.

**Khlifa R Aouadi, R Hermassi et al., (2010)**

The study was to find out the importance of plyometric training program with or without added load in male basketball players to improve their vertical jump ability, there are 27 players were randomly assigned for the study and divided into three groups, group A – plyomertic training group, group B- loaded plyometric group, group C – control group. Treatment duration was 10 weeks, 2-3 training sessions/week. The outcome measures were, 5 jump test, squat jump and counter movement jump. The result showed that standard plyometric along with loads added had shown greater improvement in both vertical horizontal jump performances in basket ball players.

**Coppack RJ, Etherington J, Wills AK et al., (2010)**

They conducted a study to investigate the exercise program in U.K army recruits to reduce the incidence of anterior knee pain. Randomized controlled trial was used for the study. Totally 50 members were selected for the study (35 male, 11 female) they were randomly allocated into two groups. One is intervention group that include four stretching and 4 strengthening exercise, other is control group is followed exciting training syllabus warm up exercises .The treatment duration was taken 14 weeks. The results indicated that the stretching and strengthening exercises are safe and beneficial to prevent the incidence of anterior knee pain in young military population who have underwent normal physical training program.

**E.Kapreli, G.Panelli et al., (2010)**

The study was conducted to find out the reliability and validity for the Greek version of Knee outcome survey Activity of daily living scale. The study included 94 patients and in this 57 was males and 37 were female with knee pathology. The patients were asked to complete the Knee outcome survey questionnaire in pre – treatment and post – treatment sessions. The results show that the Greek version of Knee outcome scale was reliable and valid and comprehensible in patients with knee pathologies.

**Morton S K, Whitehead J R et al., (2011)**

This study was to find out the effectiveness of resistance training and static stretching exercise program. There are totally 37 subjects are recruited for the study. In this 25 is randomly assigned and divided into two groups one group A resistance training and group B static stretching, remaining 12 members under group C control group. The outcome measures are included hamstring extension, hip flexion and extension, and peak torque of quadriceps and hamstring muscles. The result concluded that there is no marked difference between group A & B, but among the groups A&B showed marked improvement than group C.

**De Villarreal E S, Izquierdo M et al., (2011)**

This study was conducted to examine effectiveness of five different stimuli on jumping ability and power production, for this study 65 subjects were randomly assigned into 5 groups: group A - combination of training group, B - heavy resistance training group, C- power oriented strength training group, D - power oriented strength training with loaded counter movement jump and group E- plyometric jumping. The outcome measures included counter movement jump, loaded counter movement jump, maximum rate of force development and power output. The measurement had taken prior and after 7 weeks of training. The result showed that both slow velocity training and power oriented training alone or along with plyometrics would provide a positive stimulus to enhance jumping performance whether the training is planned and implemented properly.

**Perez-Gomez J, Olmedillas H et al., (2011)**

The study designed to find out the effect of training program included plyometric exercise along with weight lifting on kicking performance.37 male students were randomly assigned into two groups, training group and control group. Training group underwent 6 weeks treatment program that is combination of plyometrics and weight lifting. Vertical jump, running speed, Wingate and shuttle run test were the outcome measures used for the study. The

results showed that after treatment period there was no change in control group, but there was marked significant improvement in physical capacities in the training group.

**Sharma J, Golby J et al., (2011)**

This study described that if any importance of biomechanics of gait and life style factors in the prediction of medial tibial stress syndrome. In this study 468 British military recruits were selected, the outcome measures included plantar pressure variables, life style factors and aerobic fitness calculated on first day of training. Total treatment duration was 26 weeks. On the basis of data analysis the result shown that biomechanical and life style factors had great importance in prediction of medial tibial stress syndrome.

**Lim BO, Lee YS et al., (2011)**

This study was conducted to examine the role of sport injury prevention training program in female basketball players to improve muscle strength, flexibility and biomechanical properties in ACL injury. This study was a controlled laboratory study. Totally 22 high school female basket ball players were selected and randomly assigned into two groups. One is experimental group and other is control group. Experimental group underwent sports injury prevention program along with regular training program. Control group only included normal training program. Total treatment duration was 8 weeks period. Data were analyzed by ANOVA. The result showed that the sport injury

prevention training program improved the strength and flexibility of competitive female basketball players tested and biomechanical properties associated with anterior cruciate ligament injury as compared with control group.

# III. METHODOLOGY

## 3.1 STUDY DESIGN:

Two group pre test and post test Experimental study design.

## 3.2 STUDY SETTING

CRPF training camp, Thoppampatti, Coimbatore.

## 3.3 STUDY DURATION

Study was done for a period of six months.

## 3.4 SELECTION OF SUBJECTS

50 army recruits who fulfilled the selection criteria were selected for the study and were divided into 2 groups by simple random sampling method as 25 subjects in Group A and 25 subjects in group B.

## 3.5 CRITERIA FOR SAMPLE SELECTION

### INCLUSION CRITERIA

- Males
- Age group from 18 to 30 years
- Knee pain ≤ 4 in VAS
- Complains of knee pain during training programme

## EXCLUSION CRITERIA

- Soft tissue injuries surrounding knee joint
- Metal implants in lower extremity
- Recent fracture and stiffness in lower extremity
- Neurological deficit
- LBA

## 3.6 PARAMETERS

- Knee flexibility and strength

## 3.7 MEASUREMENT TOOLS

- VAS
- Sports activity scale

## 3.8 PROCEDURE

The study was conducted in CRPF training camp, Thoppampatti, Coimbatore. A questionnaire regarding general joint pain was given to all the recruits of the army camp. The purpose of this questionnaire was to find out whether the recruits have symptoms of overuse knee pain during the high intensity military training programme.

This questionnaire consisted of 20 questions of 2 pages which include the recruits demographic data, surgical history, pain, swelling and personal habits. All the recruits were explained about the purpose of the questionnaire. This questionnaire helps to find out the incidence of joint pain in army recruits during the training programme.

Upon the analysis of this questionnaire it was found out that the knee pain was the most common problem among the army recruits than other joint pain. So we selected the army recruits who have only knee pain and who were willing to participate in this study.

On the basis of selection criteria 50 recruits were selected and they were further divided into 2 groups,

Group A - Intervention group.

Group B - Control group.

All the 50 recruits daily underwent their normal regime of high intensity military training programme, which helped to improve their cardiovascular and musculoskeletal strength and endurance.

**GROUP A**

Group A the intervention group was given the planned physical training programme combined with normal army high intensity training program. The planned physical training program involves stretching exercise, strengthening exercise, fitness education and plyometrics for 12 weeks, thrice in a week. First six weeks involves stretching exercise, strengthening exercise and fitness education only and after six weeks the plyometeric training was given.

**The Stretching program** involves Hamstring, Quadriceps, Illiotibal band, Hip abductors, Hip adductors, Hip flexors, Hip extensors, Lower Back muscles, and Tendo Achilles stretching exercises.

**The Strengthening program** involves resisted exercise for Hamstring, Quadriceps, Hip abductors, Hip adductors, Hip flexors, Hip extensors, and Calf muscles.

**The Fitness education program** involves the effectiveness of proper warm up and cool down phases in the exercises section and also it contain foot ware modifications and injury prevention.

**The plyometrics program** involves power hurdles, box jump, hurdle hopping, and forward cone jumping and fitness ring.

## STRENGTHENING EXERCISES

Double Leg Squatting with weight

Single Leg Squatting with weight

Hamstring Curl

Quadriceps drill

Leg Press

Calf Raise

## STRETCHING EXERCISES

Hamstring stretch

Quadriceps stretch

Hip flexors stretch

Calf stretch

Adductor stretch

Hamstring stretch

# PLYOMETRICS

Fitness Ring

Lateral Cone Jumps

Forward Cone Jumps

Forward Step Jumps

Hurdle Jumping

Power Hurdle

**GROUP B**

Whereas the Group B (control group) subjects underwent only their normal army high intensity training programmes. In this training program they did not follow any standardised protocols. All group B subjects were undergone for running, push ups, sit ups, rope climbing, crawling, monkey climbing, and obstacle jumping etc. In the running program they covered 10-15 kilometres per session. After that they underwent 75-100 push-ups and sit-ups. Then they did terrain climbing with the help of rope. In this they covered a particular height within time limit. In monkey climbing a rope is tied between two trees, the recruits moved one end to another end through this rope .Then they went for crawling and obstacle jumping. The recruits did all this exercises with and without back bags.

With the baseline characteristics a pre-test score was taken and the post test score was taken after 12 weeks of exercise session.

The pre – test and post – test of both the Groups were compared to find out the effectiveness of high intensity military training programme with and without planned physical training programme in army recruits in prevention of the activity related injuries in knee joint.

## 3.9 STATISTICAL TOOL

Paired‘t’ test was used to asses difference between pre – treatment and post treatment values in both the groups.

Independent‘t’ test were used to asses difference between post test values of the two groups.

**Formula for paired‘t’ test:**

$$S = \sqrt{\frac{\sum d^2 - \frac{(\sum d)^2}{n}}{N-1}}$$

$$t = \frac{\bar{d}\sqrt{n}}{S}$$

d = difference between the pre-test Vs post test

$\bar{d}$ = mean difference

n = total number of subjects

S = standard deviation

$\sum d^2$ = sum of the squared deviation

**Formula of independent‘t’ test:**

$$S = \sqrt{\frac{\sum(x1-\overline{x1})^2+\sum(x2-\overline{x2})^2}{n1+n2-2}}$$

$$t = \frac{\overline{x1-x2}}{S}\sqrt{\frac{n1n2}{n1+n2}}$$

n1= total number of subjects in group A

n2= total number of subjects in group B

x1 = difference between pre test Vs post test of group A

$\overline{x1}$ = mean difference between pre test Vs post test of group A

$x2$ = difference between pre test Vs post test of group B

$\overline{x2}$ = mean difference between pre test Vs post test of group B

S = combined standard deviation

# IV. DATA ANALYSIS AND INTERPRETATION

## TABLE-I

## PAIRED‘t’ TEST

## PRE TEST AND POST TEST VALUES OF GROUP A

## (VISUAL ANALOG SCALE)

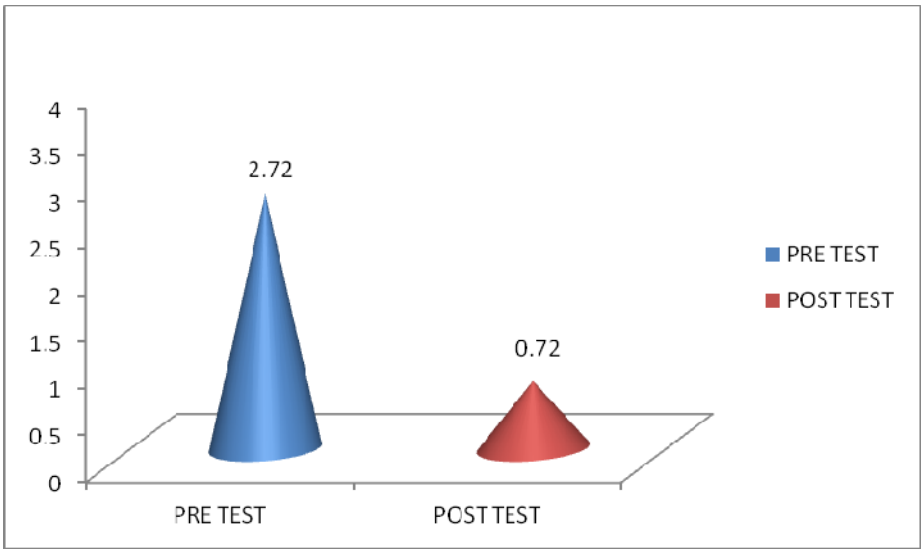
Mean values, mean differences, variance and‘t’ values of Visual Analogue Scale for Group A who is treated with planned physical training programme.

| No | VAS | Mean Values | Mean Difference | DF | Calculated ‘t’ Value | Critical ‘t’ Value |
|---|---|---|---|---|---|---|
| 1 | Pre test | 2.72 | 2 | 24 | 12.247 | 2.0638 |
| 2 | Post test | 0.72 | | | | |

While observing the data of table I, the calculated‘t’ value (12.247) is greater than critical ‘t’ value (2.0638) at 5% level of significance for two tailed ‘t’ test. Hence there is significant difference between pre and post test mean values of Visual Analog Scale score for group A subjects.

## GRAPH-I

## GRAPHICAL REPRESENTATION OF PRE-TEST AND POST-TEST MEAN VALUES OF GROUP A (VAS)



## TABLE-II

## PAIRED‘t’ TEST

## PRE TEST AND POST TEST VALUES OF GROUP B

## (VISUAL ANALOG SCALE)

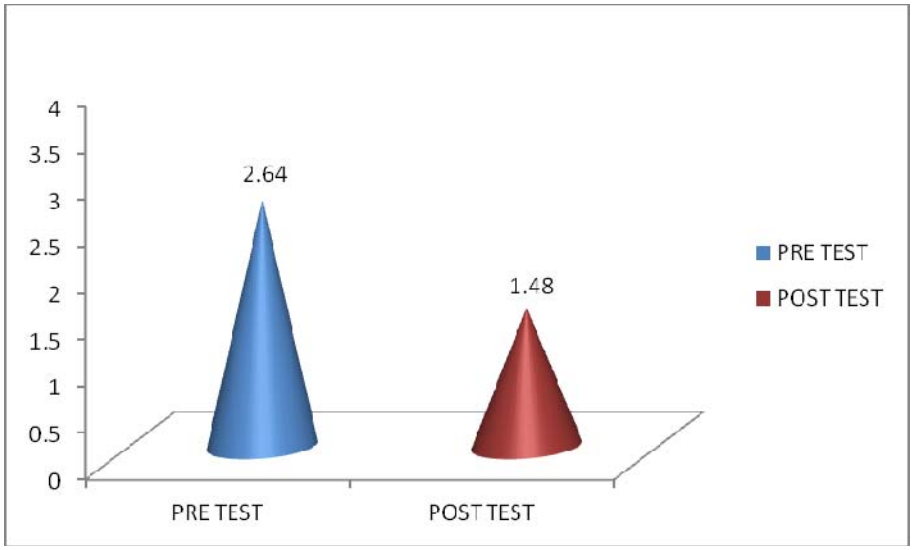
Mean values, mean differences, variance and‘t’ values of Visual Analogue Scale for Group B

| No | VAS | Mean Values | Mean Difference | DF | Calculated ‘t’ Value | Critical ‘t’ Value |
|---|---|---|---|---|---|---|
| 1 | Pre test | 2.64 | 1.16 | 24 | 10.473 | 2.0638 |
| 2 | Post test | 1.48 | | | | |

While observing the data of table II, the calculated‘t’ value (10.473) is greater than critical ‘t’ value (2.0638) at 5% level of significance for two tailed ‘t’ test. Hence there is significant difference between pre and post test mean values of Visual Analog Scale score for group B subjects.

## GRAPH-II

## GRAPHICAL REPRESENTATION OF PRE-TEST AND POST-TEST MEAN VALUES OF GROUP B (VAS)



## TABLE-III

## UNPAIRED 't' TEST

## PRE TEST VALUES OF GROUP A AND GROUP B

## (VISUAL ANALOG SCALE)

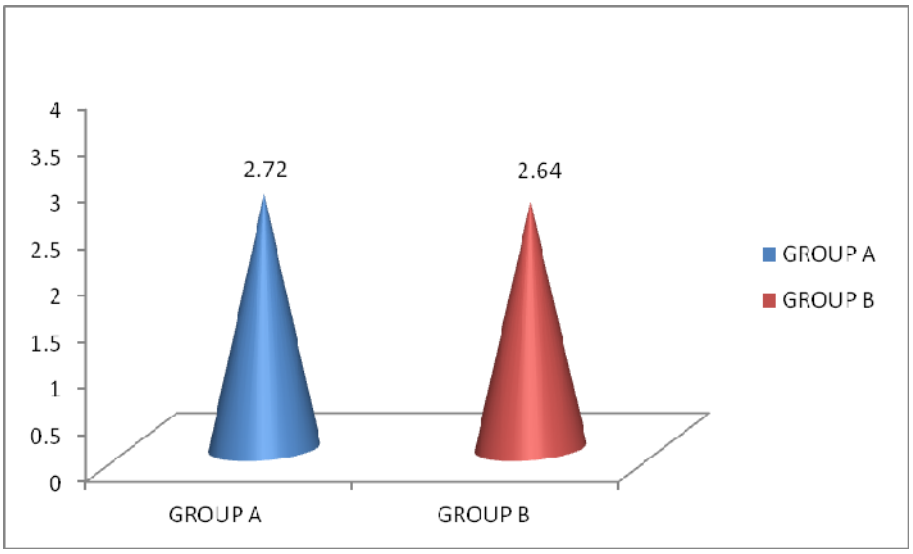
Mean, mean difference, variance and unpaired't' test of pre test values of VAS between Group A and Group B

| No | VAS | Pre-test Mean | DF | Calculated 't' Value | Critical 't' Value |
|---|---|---|---|---|---|
| 1 | Group A | 2.72 | 48 | 0.2647 | 2.0106 |
| 2 | Group B | 2.64 | | | |

While observing the data of table III, the calculated't' value (0.2647) is lesser than critical 't' value (2.0106) at 5% level of significance for two tailed 't' test. Hence there is no significant difference between pre test mean values of Visual Analog Scale score for group A and group B subjects.

## GRAPH-III

## GRAPHICAL REPRESENTATION OF PRE-TEST MEAN VALUES OF GROUP A & B (VAS)



## TABLE-IV

## UNPAIRED ‘t’ TEST

## POST TEST VALUES OF GROUP A AND GROUP B

## (VISUAL ANALOG SCALE)

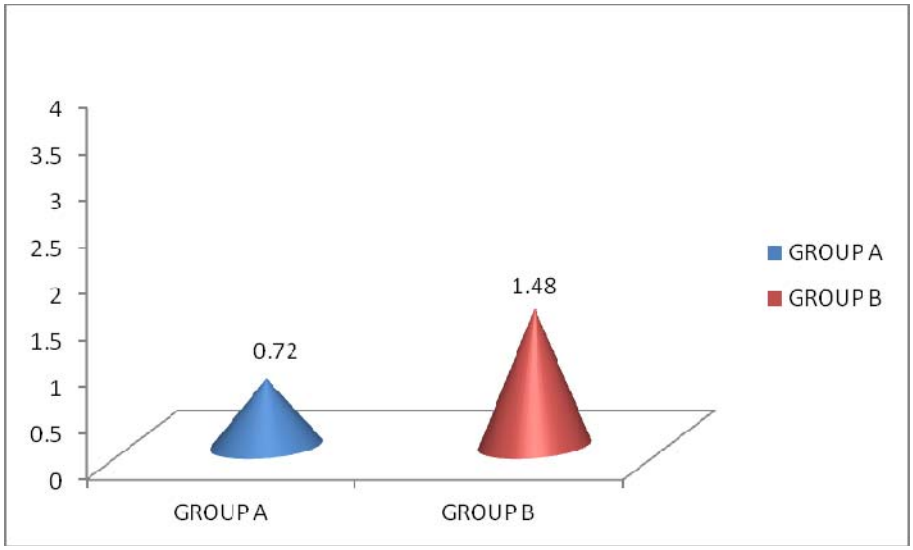
Mean, mean difference, variance and unpaired‘t’ test of post test values between VAS for Group A and Group B

| No | VAS | Mean Values | DF | Calculated ‘t’ Value | Critical ‘t’ Value |
|---|---|---|---|---|---|
| 1 | Group A | 0.72 | 48 | 3.0489 | 2.0195 |
| 2 | Group B | 1.48 | | | |

While observing the data of table IV, the calculated‘t’ value (3.0489) is greater than critical ‘t’ value (2.0195) at 5% level of significance for two tailed ‘t’ test. Hence there is significant difference between post test mean values of Visual Analog Scale score for group A and group B subjects.

## GRAPH-IV

## GRAPHICAL REPRESENTATION OF POST-TEST MEAN VALUES OF GROUP A & B (VAS)



## TABLE-V

## PAIRED‘t’ TEST

## PRE TEST AND POST TEST VALUES OF GROUP A

## (SPORTS ACTIVITY SCALE)

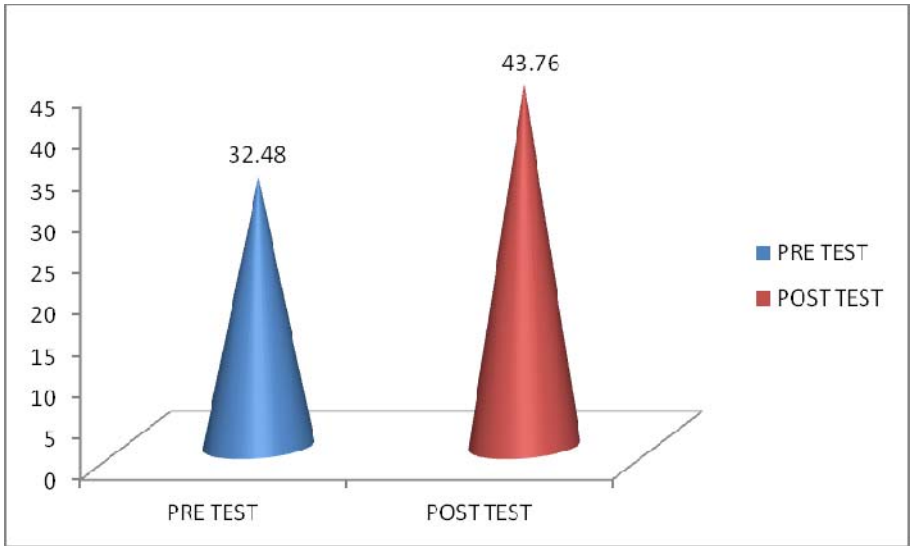
Mean values, mean differences, variance and‘t’ values of sports activity scale for Group A who is treated with planned physical training programme.

| No | SAS | Mean Values | Mean Difference | DF | Calculated ‘t’ Value | Critical ‘t’ Value |
|---|---|---|---|---|---|---|
| 1 | Pre test | 32.48 | 11.28 | 24 | 21.909 | 2.0638 |
| 2 | Post test | 43.76 | | | | |

While observing the data of table IV, the calculated‘t’ value (21.909) is greater than critical ‘t’ value (2.0638) at 5% level of significance for two tailed ‘t’ test. Hence there is significant difference between pre and post test mean values of Sports Activity Scale score for group A subjects.

## GRAPH-V

## GRAPHICAL REPRESENTATION OF PRE-TEST AND POST-TEST MEAN VALUES OF GROUP A (SAS)



## TABLE-VI

## PAIRED‘t’ TEST

## PRE TEST AND POST TEST VALUES OF GROUP B

## (SPORTS ACTIVITY SCALE)

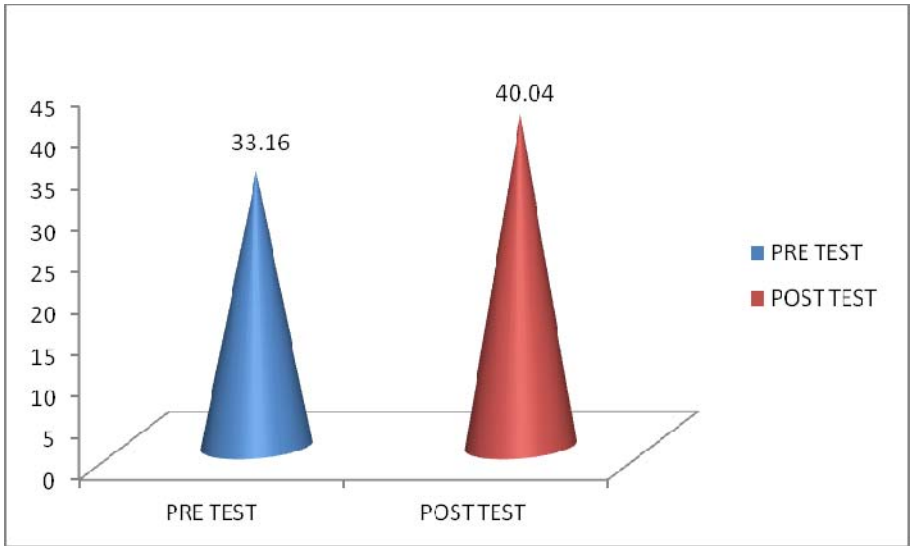
Mean values, mean differences, variance and‘t’ values of sports activity scale for Group B

| No | SAS | Mean Values | Mean Difference | DF | Calculated ‘t’ Value | Critical ‘t’ Value |
|---|---|---|---|---|---|---|
| 1 | Pre test | 33.16 | 6.88 | 24 | 22.798 | 2.0638 |
| 2 | Post test | 40.04 | | | | |

While observing the data of table I, the calculated‘t’ value (22.798) is greater than critical ‘t’ value (2.0638) at 5% level of significance for two tailed ‘t’ test. Hence there is significant difference between pre and post test mean values of Sports Activity Scale score for group B subjects.

## GRAPH-VI

## GRAPHICAL REPRESENTATION OF PRE-TEST AND POST-TEST MEAN VALUES OF GROUP B (SAS)



## TABLE-VII

## UNPAIRED 't' TEST

## PRE TEST VALUES OF GROUP A AND GROUP B

## (SPORTS ACTIVITY SCALE)

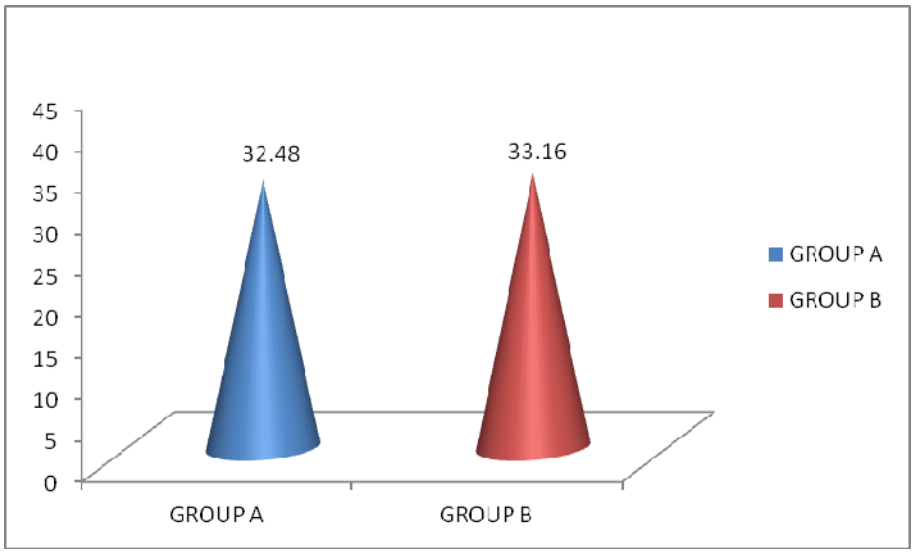
Mean, mean difference, variance and unpaired't' test of pre test values of sports activity scale between Group A and Group B

| No | SAS | Mean Values | DF | Calculated 't' Value | Critical 't' Value |
|---|---|---|---|---|---|
| 1 | Group A | 32.48 | 48 | 0.3979 | 2.0117 |
| 2 | Group B | 33.16 | | | |

While observing the data of table III, the calculated't' value (0.3979) is lesser than critical 't' value (2.0117) at 5% level of significance for two tailed 't' test. Hence there is no significant difference between pre test mean values of Sports Activity Scale score for group A and group B subjects.

## GRAPH-VII

## GRAPHICAL REPRESENTATION OF PRE-TEST MEAN VALUES OF GROUP A & B (SAS)



## TABLE-VIII

## UNPAIRED ‘t’ TEST

## POST TEST VALUES OF GROUP A AND GROUP B

## (SPORTS ACTIVITY SCALE)

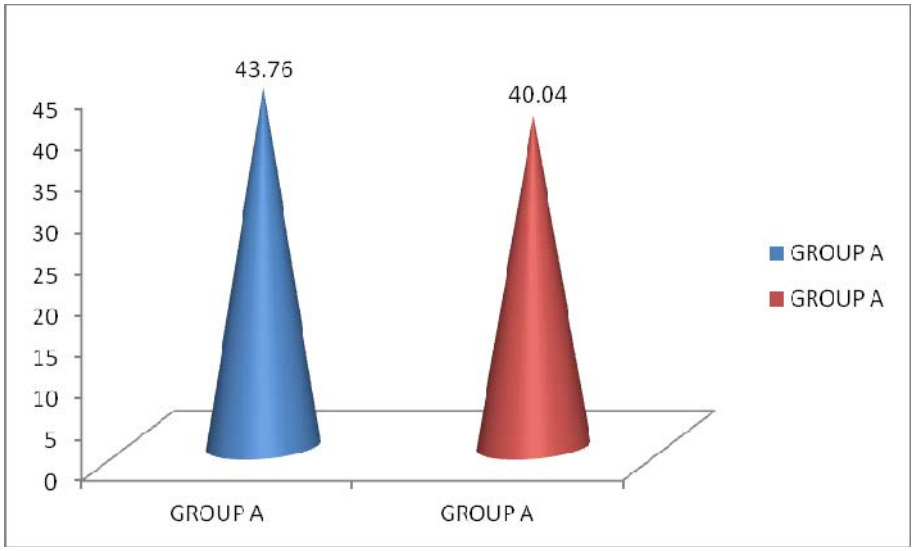
Mean, mean difference, variance and unpaired‘t’ test of post test values between sports activity scale for Group A and Group B

| No | SAS | Mean Values | DF | Calculated ‘t’ Value | Critical ‘t’ Value |
|---|---|---|---|---|---|
| 1 | Group A | 43.76 | 48 | 2.2826 | 2.0153 |
| 2 | Group B | 40.04 | | | |

While observing the data of table III, the calculated‘t’ value (2.2826) is greater than critical ‘t’ value (2.0153) at 5% level of significance for two tailed ‘t’ test. Hence there is significant difference between post test mean values of Sports Activity Scale score for group A and group B subjects.

## GRAPH-VIII

## GRAPHICAL REPRESENTATION OF POST-TEST MEAN VALUES OF GROUP A & B (SAS)



## ANALYSIS OF RESULTS

50 Army recruits are selected and divided into two groups. Group A received planned physical training programme combined with normal regime of high intensity military training programme and Group B received only normal regime of high intensity military training programme. This study was carried out for 12 weeks. Pain intensity was assessed by using visual analogue scale (VAS) and functional outcome was assessed by using sports activity scale (SAS).

In this study, Statistical analysis was done by Student‘t’ test. Paired‘t’ test was used to find out the improvement within the group. Unpaired‘t’ test was used to find out the difference between two groups.

The analysis of results shows that the calculated‘t’ value (3.04) for the post test of Visual analog scale is greater than the critical ‘t’ value (2.0195) at 5% level of significance for two tailed ‘t’ test.

The analysis of results shows that the calculated‘t’ value (2.28) for the post test of Sports activity scale is greater than the critical ‘t’ value (2.0153) at 5% level of significance for two tailed ‘t’ test.

Hence there is significant difference between post test mean values of Visual analog scale and Sports Activity Scale score for Group A and Group B subjects.

# V. DISCUSSION

The purpose of the study is to analyze the efficacy of a planned physical training programme in managing knee pain following a high intensity military training in Indian Army recruits. A total 50 subjects with knee pain were selected on the basis of inclusion criteria and were divided into 2 groups by simple random sampling method. Group A intervention group consisted of 25 subjects. Group B control group consisted of 25 subjects.

The study was conducted for a period of 6 months and the treatment duration was 12 weeks, 3 days per week. Outcome measures of Visual Analogue Scale (VAS) and Sports Activity Scale (SAS) were chose to study the pre-test and post-test values . Pain was measured using VAS and the level of physical function was measured by SAS.

Knee pain is the most common activity related injury of the lower limb. Army recruits undergo an initial arduous physical training programme. This training increase the physical demand and it will cause training related injuries. Many studies show that knee is the most common site for overuse complications in runners.

Studies shows that the overall injury incidence in army recruits during the training programme is 40%. Jones et al.,(1993) studied that the incidence of the lower limb injury in male US Army recruits to be 37% .

Previous studies done among the non UK military recruits have reported the incidence of anterior knee pain at 5 – 15 %.

Pallavi Sharma (2011) studied the effects of stretching and strengthening exercise in improving the physical condition of the people with anterior knee pain.

Coppack et al., (2010) studied that the effects of stretching and strengthening exercise in young military population and based on the results they concluded that this physical conditioning programme reduced the incidence of knee pain

Myer et al., (  ) studied the effects of plyometrics and dynamic stabilization of balance training programme on lower extremity biomechanics. On the basis of the results they concluded that both the plyometrics and balance training reduced the lower extremity valgus during a drop in a vertical jump and a single leg drop and due to this the chance of ACL injury was reduced to a greater extent .

Kaufman et al., (2000) studied that the efficacy of programmes to reduce injury in military population through adjusting the physical training program and conditions of training regimes.

# VI. SUMMARY AND CONCLUSION

The purpose of the study is to analyze the efficacy of a planned physical training programme in managing knee pain following a high intensity military training in Indian Army recruits. A total 50 subjects with knee pain were selected on the basis of inclusion criteria and were divided into 2 groups by simple random sampling method. Group A intervention group consisted of 25 subjects. Group B control group consisted of 25 subjects.

The study was conducted for a period of 6 months and the treatment duration was 12 weeks, 3 days per week. Outcome measures of Visual Analogue Scale (VAS) and Sports Activity Scale (SAS) were chose to study the pre-test and post-test values . Pain was measured using VAS and the level of physical function was measured by SAS.

After 12 weeks of planned physical training programme the values were collected using the outcome measures. The values of pre – test and post – test were calculated using paired and unpaired‘t’ test. The differences between the treatment groups were noted.

On the basis of statistical analysis the subjects in Group A showed a marked improvement in physical condition than the subjects in Group B.

## CONCLUSION

1. There was a significant improvement of physical condition in both groups.
2. There was a decrease occurrence of knee pain in Group A when compared with Group B.
3. When compared with the normal high intensity training programme, the planned physical training programme reduced the occurrence of knee pain in the army recruits.
4. When compared with the high intensity training programme the planned physical training programme will have a significant difference on the training related injuries.

So this study concluded that a chance of knee injury was significantly reduced through the planned physical training programme.

# VII.LIMITATIONS AND RECOMMENDATIONS

## LIMITATIONS OF THE STUDY

1. Only young male military recruits were included in this study.
2. Knee pain was the only symptom focused on this study.
3. The study was done only with a small group of army recruits, for more accurate results the study has to be conducted in a large group of army recruits.
4. Factors like personal habits, climate conditions and psychological factors were not controlled during the study period.

## FUTURE RECOMMENDATIONS

1. Other training related injuries should be focused in future studies
2. Effects of smoking and alcoholic habits on physical condition of the army recruits should be studied.
3. Hands on approach like manipulation should be compared with therapeutic exercise.
4. Female military recruits should also be studied in future.
5. Occurrence of training related injuries in other sports activities should be studied.
6. Develop, implement and evaluate a physical fitness and safety strategy that combines system –wide and local initiatives to increase lifelong participation in fitness activities and reduce injury in military recruits.
7. Research programmes for maintenance of fitness after basic training.

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# IX.APPENDIX

## APPENDIX-I

### KNEE PAIN

According to the studies the training related lower limb injuries are of 48% in this 33% are knee joint injuries.

Improper running, jogging causes 80% of lower limb injuries and in this 20% is knee pain.

Researchers say that knee pain is the most common problem. Knee pain has been structured to affect one in four active individuals. Studies suggest that abnormal tracking of the patella is the major contribution in the knee pain. Army recruits and sports persons commonly encounter with knee pain.

Studies suggest that excessive foot pronation is a major cause for knee pain. Stretching and strengthening exercise help in prevention of knee pain among army recruits.

## APPENDIX – II

## PLANNED PHYSICAL TRAINING PROGRAMME

Planned physical training programme consist of stretching, strengthening, fitness education and plyometrics. It helps to improve the physical condition of army recruits.

Planned physical training programme helps in prevention of injury that will occur due to high regime of normal exercise programmes during the session in army recruits.

It also helps in improving the agility and movement skills of the army recruits.

It helps to improve the cardio vascular and musculo skeletal endurance so that the fatigue resistance will also be increase during training session.

## APPENDIX-III

# PLYOMETRICS

Plyometrics are type of exercise training which involves fast and powerful movements to improve the functions of the nervous system and it helps in improving the performance in sports.

The muscles tension generated by the rapid stretching helps in development of a potential elastic energy and there is an increase in the concentric force of the muscle.

Plyometrics helps in generation of a forceful movement.

## APPENDIX-IV

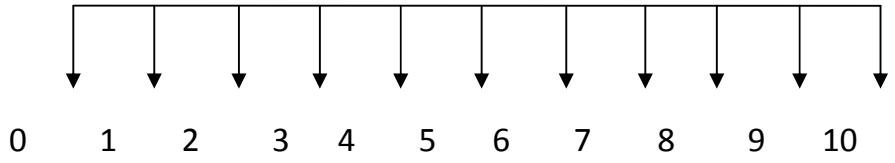
## NORMAL REGIME OF HIGH INTENSITY TRAINING PROGRAMME

Normal regime of high intensity programmes provides foundational fitness and fundamental motor skill development. The overall goal of the army physical fitness training programme is to develop soldiers who are physically capable, ready to perform their duty assignments. They will not assess each and every person for their functional ability so all the members must follow the same exercises protocol. Which includes running, push ups , sit ups , rope climbing , crawling , monkey climbing , and obstacle jumping etc. In the running program they will cover 10-15 kilometres per section. After that they will do 75-100 push-ups and sit-ups.Then they do terrain climbing with the help of rope. In this they will cover particular heights within time limit. In monkey climbing a rope is tied between two trees, the recruits will move one end to another end through this rope .Then they go for crawling and obstacle jumping. The recruits do all this exercises with and without back bags.

# APPENDIX - V

## VISUAL ANALOGUE SCALE (V.A.S)

VAS – It is used to measure the intensity of pain




No pain Worst pain

Visual analogue scale consists of 10 cm horizontal line with two end points, labelled no pain and worst pain respectively. The patient is requested to place mark on the 10 cm line to know their pain intensity at that particular time (Presently Feels).

The distance in centimetres from the lower end of VAS to the patients mark is used as a numerical index to assess the severity of pain.

# APPENDIX – VI

## SPORTS ACTIVITY SCALE

The SAS is a 11 item scale that queries patients about how their symptoms effect their ability to perform sports and recreational activities (7 items) as well as how their knee condition effects their ability to perform specific sports related skills such as straight running, jumping and landing, quick stopping and starting, cutting and pivoting (4 items). The scoring in this scale is from 0-5 for 11 items. The highest possible score is 55 and the sum of scores is divided by 55 and multiplied by 100 to give an overall SAS percent rating. Higher percentage ratings reflect higher levels of sports and recreational function. This scale was developed to assess higher levels of physical function for patients with knee pathology.

# KNEE OUTCOME SURVEY SPORTS ACTIVITIES SCALE (SAS)

Symptoms : to what degree does each of the following symptoms affect your level of sports activity? ( check one answer on each line )

| | Never have | Have but does not affect my sports activity | Affect sports activity slightly | Affect sports activity moderately | Affect sports activity severely | Prevents me from all sports activity |
|---|---|---|---|---|---|---|
| Pain | | | | | | |
| Grinding or grating | | | | | | |
| Stiffness | | | | | | |
| Swelling | | | | | | |
| Slipping or partial giving way of knee | | | | | | |
| Buckling or full giving way of knee | | | | | | |
| Weakness | | | | | | |

Functional limitation with sports activities : how does your knee affect your ability to:( check one answer on each line)

| | Not difficult at all | Minimally difficult | Somewhat difficult | Fairly difficult | Very difficult | Unable to do |
|---|---|---|---|---|---|---|
| Run straight ahead | | | | | | |
| Jump and land on your involved leg | | | | | | |
| Stop and start quickly | | | | | | |
| Cut and pivot on your involved leg | | | | | | |

**Scoring :** The first column is scored 5 points for each item, followed in successive columns by scores of 4,3,2,1 and 0 for the last column. The total points from all items are summed, then divided by 55 and multiply by 100 for the SAS score. For example, if the individual places marks for 9 items in the first column , and 2 items in the second column the total points would be 9*5=45 points, plus 2*4=8 points, for a total of 53 points. The sas score would then be 53/55*100=96%.

# APPENDIX – VII

## GENERAL QUESTIONNAIRE

1) Name:.....

2) Age :.....

3) Gender: ( ) male ( ) female

4) Height:.....cm

5) Weight:.....kg

6) Do you have any previous history of ( )soft tissue injury ( )fracture ( )surgery

7) If yes please explain it.....

.....

.....

8) Current pain is: ( )absent ( )mild ( )moderate ( )severe

9) Pain on visual analogue scale

0.....5.....10

10) Now in which joint you have pain:

( )shoulder ( )elbow ( )wrist ( )hip ( )knee ( )angle ( )neck( )back

11) Onset of pain: ( ) sudden ( ) gradual

12) Side of pain : ( ) right ( ) left ( ) both

13) Type of pain: ( ) dull ( ) sharp ( ) aching ( ) throbbing

14) Pain occurs at:( )rest ( )during activity

15) Pain is made worse by: ( )walking ( )weight bearing ( )walking upstairs ( )sitting for a long time and getting up ( )jumping ( )squating or kneeling ( )running

16) Did you notice any swelling: ( ) yes ( ) no

17) If yes swelling is : ( ) mild ( ) moderate ( ) severe

18) Do you have any following problems : ( ) fever ( ) numbness ( ) weakness ( ) unexplained weight loss ( ) difficulty to controlling bowel and bladder movement

19) How often do you drink alcoholic beverages

( ) never ( ) rarely ( ) more than 2 time /week

20) Tick box if you: ( ) currently smoke tobacco

( ) ex-smoker ( ) have never smoked

## APPENDIX-VIII

## FITNESS EDUCATION

Overuse injuries are caused by chronic, repetitive micro trauma usually related to sports, causing, sub maximal insults to local tissues and resulting in the onset of pain.

Overuse injuries to the knee are common in athletes, usually because of a training error such as doing too much too quickly.

The athlete should also undergo a physical evaluation before adjusting his or level of competition. Increases in activity duration frequency, and intensity should be gradual. For running sports the "10% per week" rule (an increase in activity by 10% each week) can be used as guide line in increasing the duration and intensity of training. Trainees who have a history of overuse injury may benefit from stretching and strengthening programs.

## APPENDIX - IX

## PRINCIPLES OF INJURY PREVENTION

Physical condition is a key principle of injury prevention. Appropriate conditioning programmes decrease the risk of injury, decrease the severity of an injury if it occur, and can help prevent re-injury.

Maximising the chance for safe athletic performance requires adequate muscular strength and balance, power endurance, neuromuscular coordination, joint flexibility, cardiovascular endurance, and good body composition for sport.

Strengthening the muscles of a joint,helps reduce injuries to the area. Regular exercise can significantly increase the strength of the ligaments surrounding the knee and prevent knee injuries; development provides increased strength that helps to stabilise joints; and improved movement skill is important in avoiding injury.

Proper conditioning can prevent the muscle from undergoing on unwanted movement.

Efficient performance requires a full range of motion, and adequate joint flexibility also decreases on athletic susceptibility to injury.

Cardiovascular endurance is also a factor in injury prevention. The cardio vascular and respiratory systems must be adequately conditioned to delay the onset of fatigue.

Adequate sleep is also important for good general and mental health and becomes critical for recovery after intensive workouts.

Shoes are the most critical piece of a track and field athlete's equipment and should be individually and carefully selected.

Replace old shoes every 300-400miles of at least 6months and try not to use your running shoes as your everyday shoes.

Extreme heat and humidity, cold and altitude can adversely affect performance in many athletic events. To avoid dehydration and the fatigue that can occur from inadequate fluid replacement, athletics must drink extra water, juices, and other liquids

## APPENDIX – X

**CONSENT FORM**

This is to certify that I _____ freely and voluntarily agree to participate in the study **" AN EXPERIMENTAL STUDY TO ASSESS THE EFFICACY OF A PLANNED PHYSICAL TRAINING PROGRAMME IN MANAGING KNEE PAIN , FOLLOWING HIGH INTENSITY MILITARY TRAINING IN INDIAN ARMY RECRUITS"**

I have been explained about the procedures and the risks that would occur during the study.

Participant:

Witness:

Date:

I have explained and defined the procedure to which the subject has consented to participate.

Researcher:

Date